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RHEUMATOID ARTHRITIS

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ABSTRACT. Forty-two consecutive knee arthroplasties on rheumatoid knees (19 Attenborough, 20 Total Condylar, 3 Marmor) were examined pre- and postoperatively for signs of below-the-knee nerve lesions. Sixteen of these knees were also studied neurophysiologically (EMG). Four patients (knees) had peroneal nerve palsy, three early and one late. Three further knees had only EMG signs of nerve lesion. Predisposing factor was correction of flexion contracture of more than 10 degrees and especially when combined with varus change in alignment. Preoperative EMG could not predict nerve lesion.

Peroneal nerve palsy is a rare and often briefly reported complication following knee arthroplasty. The reported incidence is usually around 2%. The palsy is in most cases transient (1, 6, 11, 12, 13, 17). Studies on the peroneal nerve in rheumatoid arthritis (RA) have shown changes in the motor nerve conduction velocity without clinical signs of neuropathy (14). Local pressure and oedema as well as stretching of the nerve when a valgus deformity is reduced during knee arthroplasty are considered to be some of the causes of postoperative nerve palsy (11).

This report describes the pre- and postoperative incidence of below-the-knee nerve lesions in RA patients treated with knee arthroplasty. Clinical and neurophysiological methods were used. For comparison, a report is given on the incidence of peroneal nerve palsy in a nation-wide computerized follow-up of knee arthroplasties in Sweden, where all reported complications have been recorded.

PATIENTS AND METHODS

Forty-one consecutive patients treated with 42 knee arthroplasties at the Department of Orthopaedic Surgery and Rheumatology in Lund, Sweden during 1980 were

studied. The Marmor Modular Knee was used in 3 arthroplasties, the Total Condylar Knee in 20 and the Attenborough stabilized prosthesis in 19. Eight arthroplasties were revisions of arthroplasties with biomechanical failure and 2 were revisions of arthroplasties with low virulent deep infections with positive cultures at the revision but without fistulas. There were 27 female and 14 male patients with a mean age of 54 years (range 18-76). Thirty-eight patients had classical RA according to ARA (9) and 3 had juvenile RA according to ARA (4).

All patients have been clinically examined for any preoperative signs of sensory and motor nerve symptoms and then re-examined repeatedly postoperatively. In all cases of radiating pain or palsy an electromyography (EMG) was performed both postoperatively and after 4 months. All arthroplasties were performed with a tourniquet in bloodless field and the tourniquet time was recorded. The change in varus-valgus alignment before and after arthroplasty was calculated radiographically. In most cases the radiograph was taken with the patient standing on the examined leg in a defined frontal plane including hip-, knee- and ankle joint. The extension deficiency was measured with a goniometer pre- and postoperatively when good muscle control was established. The duration of the postoperative hospitalization was recorded. The patients were observed for 6 months or until recovery of a possible nerve injury.

A neurophysiological investigation was performed on 16 of the above-mentioned patients before operation and at an average 34 days postoperatively (range 27-48). Ten women and 6 men were included, with a mean age of 51 years (range 25-67). The investigation included determination of the motor conduction velocities of the peroneal and posterior tibial nerves bilaterally. The maximum response amplitudes were recorded with surface electrodes from the extensor digitorum brevis and hallucis muscle bilaterally.

Amplitudes and latencies of the gastrocnemius-soleus tendon jerk were determined electrophysiologically with a reflex hammer having an electric switch triggering the oscilloscope of the EMG equipment (DISA 1500). Sensory nerve action potentials and sensory conduction velocities were measured with surface electrodes from the superficial peroneal nerve and the sural nerve bilaterally.

Electromyography was performed with concentric electrodes inserted into the anterior tibial and gastrocnemius-soleus muscles bilaterally. Motor unit potentials were sampled at nine different recording sites in each muscle and classified in terms of amplitude, duration and degree of polyphasia. Denervation activity was looked for in each recording position.

The Marmor Modular prosthesis was used in stable knees with minor deformity, the Total Condylar Knee in the moderately damaged knee with reducible deformity and the Attenborough prosthesis in the severely damaged knee with fixed deformity. In knees with reducible deformity, bone resection was used for realignment. Fixed deformity was reduced with both bone resection and release of the collateral ligament and/or posterior capsulotomy. The wound was usually closed before releasing the tourniquet. Suction drainage was put in laterally for 24 to 36 hours. A Robert Jones'-like bandage was used. The leg was raised postoperatively some 15 degrees on a splint and the knee kept in extension.

The Swedish Knee Arthroplasty Project was started by the Swedish Orthopaedic Society in October 1975 (2). Today all departments of orthopaedic surgery in Sweden participate. All knee arthroplasties primarily performed after the date of the onset of the project are to be reported for computer filing. The initial report after each arthroplasty contains information on knee condition, endoprosthesis used, local or general antibiotic prophylaxis, duration of hospitalization and all local and major general complications during the hospital stay. Through computerized enquiries patients are followed-up for complications at one, 3 and 6 years postoperatively. Five thousand arthroplasties were recorded 1981. The computer terminal is located at the Department of Orthopaedic Surgery in Lund.

RESULTS

Among the 41 patients with 42 knee arthroplasties examined, 4 had clinical signs of peroneal nerve palsy postoperatively that could be verified by electrophysiological methods.

No patient had clinical signs of nerve lesion below the knee before the operation. Two of the patients treated with an Attenborough prosthesis developed the nerve palsies immediately after the operation, one with complete peroneal nerve palsy and one with reduction of sensitivity to touch on the anterior side of the operated leg. One patient with a Total Condylar Knee developed a complete nerve palsy after 24 hours. The fourth patient with an Attenborough prosthesis and a known coagulopathy was symptomless for 5 months but then during training developed hemarthrosis of the operated knee and a total peroneal nerve palsy with a considerable delay in training. Three more knees (two Attenborough and one Total Condylar) ex-

bited only neurophysiological signs of peroneal nerve palsy with no symptoms, making a total of seven nerve lesions in 42 arthroplasties. All of the early nerve palsies were restituted at the 6-month follow-up.

Among the 16 patients also examined neurophysiologically were the patient with complete paralysis of the peroneal nerve (Attenborough) and the patient with a reduction of sensitivity to touch (Attenborough). One further patient reported a transient numbness of the toes on the operated side during the first postoperative week but a nerve lesion could not be verified.

At the preoperative examination, 4 of the 16 patients showed mild neurogenic changes of the motor unit potentials of the anterior tibial muscles. Two of these 4 patients also exhibited mild neurogenic changes in the gastrocnemius-soleus muscles. None of the patients exhibited any denervation activity at the preoperative test.

At the postoperative examination, 5 patients showed denervation activity in muscles innervated by the peroneal nerve. The 2 patients mentioned above with remaining symptoms of a nerve lesion showed denervation activity at the EMG examination. Two of the patients showed denervation activity in muscles innervated by the posterior tibial nerve as well. Conduction velocities and response amplitudes of peroneal and posterior tibial nerves on the operated side are summarized in Table I, together with observed changes at the postoperative examination.

The preoperative conduction velocities and response amplitudes among patients who showed signs of denervation at the postoperative examination did not differ from those without denervation.

The patients exhibiting EMG signs of denervation postoperatively also showed a significant reduction in response amplitudes, whereas the conduction velocities were only slightly reduced. Both cases with denervation of the gastrocnemius-soleus muscles showed a remaining gastrocnemius-soleus tendon reflex with a slightly reduced response amplitude.

Sensory nerve action potentials in the superficial peroneal nerve were recorded in only 6 out of 16 cases preoperatively and in the sural nerve in 12 out of 16 cases. Amplitudes of sensory responses were quite variable and there was no clear correlation between denervated cases and loss of sensory nerve action potentials.

In 35 knee arthroplasties without nerve lesions

Table I. Motor conduction velocities of peroneal (MCV_{PER}) and posterior tibial nerves ($MCV_{TIB POST}$) at the preoperative examination

The compound motor action potentials of the extensor digitorum brevis muscle ($CMAP_{PER}$) and abductor hallucis muscle ($CMAP_{TIB POST}$) are also given. ΔMCV and $\Delta CMAP$ denote changes observed at the postoperative examination related to pre-op. Values are expressed as means $\pm$ SEM

	MCV_{PER}	ΔMCV_{PER}	$CMAP_{PER}$	$\Delta CMAP_{PER}$
Denervated ($n=5$)	49.0 ± 1.27 m/s	-1.6 ± 3.18	3.2 ± 0.71 mV	-2.2 ± 0.68
Not denervated ($n=11$)	43.5 ± 1.25	-0.3 ± 0.65	3.7 ± 0.45	-0.5 ± 0.31
	$MCV_{TIB POST}$	$\Delta MCV_{TIB POST}$	$CMAP_{TIB POST}$	$\Delta CMAP_{TIB POST}$
Denervated ($n=2$)	45.8 ± 0.75	-0.25 ± 1.75	16.0 ± 1.50	-6.0 ± 2.5
Not denervated ($n=14$)	41.5 ± 1.09	0.9 ± 0.56	6.2 ± 0.89	0.2 ± 0.51

the mean improvement in the knee extension was 5 degrees (range 15 degrees loss to 25 degrees improvement). In seven knee arthroplasties with nerve lesions the mean improvement in extension was 20 degrees (range 0–40 degrees). The difference is highly significant ($p < 0.001$). The knees without nerve lesions had a mean change in varus–valgus alignment of 0 degrees (range 15 degrees variation to 25 degrees valgisation) and knees with nerve lesions had a mean change of 7 degrees variation (range 15 degrees variation to 7 degrees valgisation) (significant, $p < 0.05$).

(Statistical calculations with conventional significance and discriminate analysis were performed by Klas Svensson, Institute of Statistics, University of Lund, Lund, Sweden.)

Knees without nerve lesion were operated with a mean tourniquet time of 107 minutes (range 30–135 min) and knees with nerve lesion with a mean tourniquet time of 120 min (range 105–130 min) (not significant, $p > 0.05$).

The mean duration of the hospital stay was 37 days (range 17–83) for patients without nerve lesions. The mean hospital stay for 7 patients with nerve lesion was 53 days (range 27–92) (significant, $p < 0.05$) and the stay for the 3 patients with early clinical peroneal nerve palsy was 32, 59 and 78 days, respectively.

The Swedish Knee Arthroplasty Project has recorded 43 peroneal nerve palsies in 2273 rheumatoid knees treated with arthroplasties (see Table II).

Table II. Peroneal nerve palsy after knee arthroplasty for rheumatoid arthritis

Forty-two knees operated on in Lund in 1980 and 2273 knees operated on in Sweden from Oct. 1975 to May 1981

	Lund			The Swedish Knee Arthroplasty Project		
	Jan. 1980–Dec. 1980			Oct. 1975–May 1981		
	Arthroplasties <i>n</i>	Nerve lesion <i>n</i> %		Arthroplasties <i>n</i>	Nerve lesion <i>n</i> %	
<i>Stem prosthesis</i>						
Hinged	–	–	–	263	12	4.5
Stabilized	19	3	16	196	3	1.5
<i>Surface replacement</i>						
Bi- and tricompartmental	20	1	5	994	13	1.3
Unicompartmental						
Medial and lateral	3	0	0	648	14	2.2
Medial or lateral	–	–	–	172	1	0.5
Total	42	4	10	2 273	43	1.9

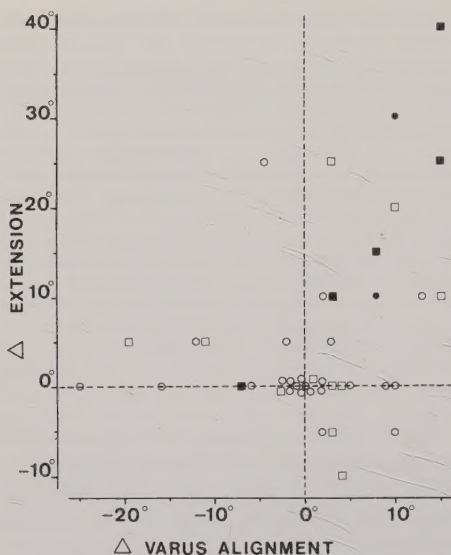


Fig. 1. The difference (Δ) in pre- and postoperative extension, varus (-valgus) alignment, and occurrence of below the knee nerve lesions, in 42 rheumatoid knees operated with an arthroplasty. EMG-examined knees with nerve lesion ■, and without □. Clinically examined knees with peroneal nerve palsy ●, and without ○.

DISCUSSION

The reported incidence of peroneal nerve palsies in rheumatoid knees from the Swedish Knee Arthroplasty project is 1.9%. The specificity of the computerized enquiries regarding complications thus seems as good as and in accordance with other small, thoroughly investigated materials (1, 3, 5, 6, 7, 11, 13, 16). The high incidence (10%) of clinical peroneal nerve palsies in the present study may indicate that this complaint was of serious proportions and Freeman, Swanson & Todd (1973) also reported 8% and Langer-Andersen (12) 6% nerve palsies in strictly rheumatoid knees.

With the help of discriminant analysis the most predictive factor was found to be the reduction in flexion deformity followed by correction of the valgus deformity. Five out of seven knees with nerve lesion obtained by the operation a reduced flexion and valgus deformity and one had a reduced flexion and varus deformity (6). Stretching of the nerve thus may have contributed in 6 cases (10, 18). Two of the 4 patients with clinical nerve lesion had a free interval postoperatively (24 hours

and 5 months) indicating a contributory factor such as external pressure and/or swelling.

The Attenborough prosthesis was used in five of seven knees with nerve lesion and the Total Condylar Knee in the remaining two (one delayed and one sub-clinical nerve lesion). The choice of prosthesis does not in itself create the problem, as the choice depends on the differing degrees of knee deformity. There is no indication that neuropathy of the preoperative nerve would constitute an important predisposing factor for peroperative nerve damage. The risk of over-stretching the nerve may be reduced if bone resection instead of release and capsulotomy is used when possible (18) (see Method). In knees with fixed flexion deformity the peroneal nerve can be released and inspected during operation through a separate lateral incision (11). The tourniquet should be released prior to wound closure for better hemostasis. It is also important that bandages and plasters are well padded and the lateral side of the knee protected against pressure (5, 7, 16). Knees with reduced flexion deformity may be put in slight flexion during the first postoperative days (10).

Patients for whom more than 10 degrees of correction of a flexion deformity is expected should be informed about the risk of nerve lesion (one out of three) leading to prolonged postoperative training and hospitalization.

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